



# WeatherStation® Instrument

## Owner's Guide

Model PB200



Record the serial number found on the WeatherStation® instrument.

Serial No. \_\_\_\_\_

Date of Purchase \_\_\_\_\_

Copyright © 2008 Airmar Technology Corp. All rights reserved.

## Table of Contents

Introduction.....	4
Safety Instructions.....	5
Adding an External Speed-Through-Water Sensor.....	6
Parts, Tools & Materials.....	7
Choosing the Mounting Location.....	9
Installing.....	10
Cable Routing & Connecting Guidelines.....	13
Connect to an NMEA 0183 Display.....	14
Connect to an NMEA 2000® Network.....	16
Calibrating the Compass.....	17
Software.....	17
Maintenance.....	17
Where to Purchase Parts.....	18
Troubleshooting.....	18
Appendix A—How the WeatherStation® Instrument Works.....	20
Appendix B—Technical Information.....	26
Acronyms & Glossary.....	27

**IMPORTANT: Please read the Owner's Guide completely before proceeding with the installation.**

## **Introduction**

Thank you for purchasing the Airmar ultrasonic WeatherStation instrument. This exciting product is actually six different sensors in a single unit—without any moving parts. The compact housing is waterproof with a single removable cable. Data is output in digital NMEA 0183 and NMEA 2000® formats.

## **Functions of the WeatherStation Instrument**

- Apparent wind speed
- Apparent wind direction
- Magnetic compass heading
- Air temperature
- Wind chill temperature
- Rate of Turn
- Angle of vessel pitch
- Angle of vessel roll
- Barometric pressure
- Global Positioning System (GPS)
- Vessel speed over ground (SOG)
- Vessel course over ground (COG)
- True wind speed
- True wind direction
- Heading relative to true north
- True wind chill temperature
- True wind speed relative to water—requires speed-through-water input

## WARNING

**Navigation Aid Only**—The WeatherStation instrument is only an aid to navigation and should never be solely relied upon. It is not a replacement for traditional navigation aids and techniques. Only official government charts contain all the information needed for safe navigation.

## Safety Instructions

### **WARNING: Electrical Safety**

The power supply voltage must be 12 VDC ( $\pm 3$ VDC). Any other voltage may damage the product and/or result in fire, damage to the boat, and/or personal injury.

### **WARNING: Fuse or Circuit Breaker**

A safe installation requires a 1 amp fast-blow fuse or circuit breaker. Failure to do so may damage the product and/or result in fire, damage to the boat, and/or personal injury.

### **WARNING: Installation Safety**

Always wear safety goggles and a dust mask when installing to avoid personal injury.

### **CAUTION: Correct Installation Important**

The WeatherStation instrument must be installed and operated according to the instructions in this owners guide. Failure to do so may result in poor product performance.

### **CAUTION: Disassembly**

Do not disassemble the sensor. Removing the screws from the WeatherStation instrument will damage the waterproof seal, thus voiding the warranty.

### **IMPORTANT: Compass Safe Distance**

The compass safe distance for standard and steering compasses is 1 m (3'). Observe this distance to prevent interference to a magnetic compass.

### **IMPORTANT: Calibrating the Compass**

The internal compass must be calibrated. Failure to do so may result in inaccurate compass readings.

### **IMPORTANT: Battery**

Make power connections to a 12 VDC power source that is isolated from the engine start battery(s). Voltage drops may cause the instrument to lose information and/or change operating mode.

## The Importance of Understanding True Wind Direction

When the WeatherStation instrument is stationary, the direction *from which* the wind is blowing is known as the *true wind*. The WeatherStation instrument is programmed to measure the direction based upon the specific orientation of the sensor. For the WeatherStation instrument to accurately calculate the true direction of the wind, *it must be installed and oriented correctly*. (To learn more about true and apparent wind direction, see Appendix A.)

## Adding an External Speed-through-Water Sensor

The WeatherStation instrument can receive data from an external sensor when it is connected through an optional NMEA 0183 Combiner or connected to an NMEA 2000 network. An external speed sensor processes additional received data and transmits it to the WeatherStation instrument for use in true wind calculations. In the case of NMEA 0183 protocol, simply connect the sensor to an NMEA 0183 Combiner or other NMEA 0183 repeater hardware. The data provided can be seen on displays connected to the Combiner. An NMEA 2000 speed sensor can be connected to an NMEA 2000 network.

**NOTE:** *When an external speed sensor is connected to both an NMEA 0183 device and an NMEA 2000 network, the WeatherStation instrument will use NMEA 2000 data.*

**Speed-through-water sensor**—An external speed sensor can be installed, such as an Airmar Smart™ Sensor. Airmar recommends installing the DST800V to receive water depth, boat speed, and water temperature data.

# Parts, Tools & Materials

## Cables, Converting, and Connecting Hardware

The WeatherStation instrument can be connected to a device and/or network in several ways. *You must have the correct cable* and any needed junction box before *beginning the installation*. Note that additional cable lengths are available.

### Cables

**NOTE:** Additional cable lengths are available.

- |                    |     |                     |
|--------------------|-----|---------------------|
| • NMEA 0183 Cable  | 10m | Part No. 33-862-02  |
| • NMEA 2000® Cable | 6m  | Part No. 33-1029-02 |
| • NMEA 2000® Cable | 10m | Part No. 33-1029-06 |

### Junction Boxes

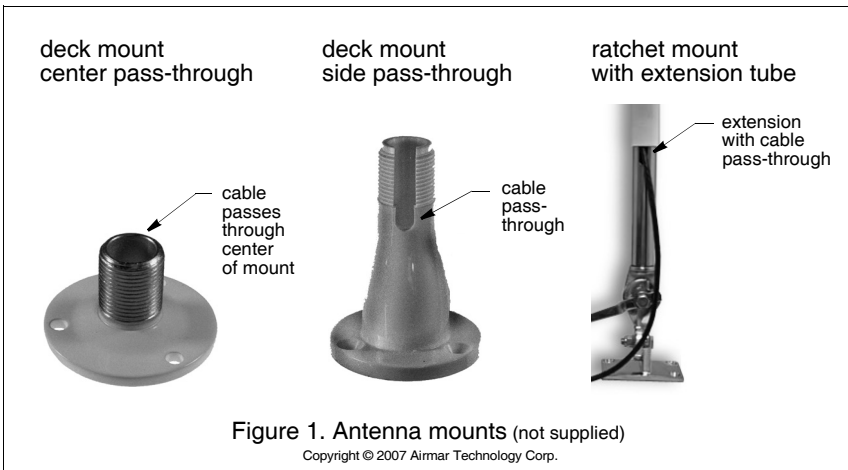
- |   |                    |
|---|--------------------|
| • NMEA 0183 to USB Converter              | Part No. 33-801-01 |
| • NMEA 0183 Combiner                      | Part No. 33-800-01 |
| • NMEA 2000® CAN to USB Converter         |                    |
| • NMEA 0183 & NMEA 2000® Junction Box Kit | 15m                |
| • NMEA 0183 & NMEA 2000® Junction Box Kit | 30m                |

### Antenna Mount

Antenna mount with standard marine 1" -14 threads and pass-through for cable (see Figure 1).

Hardware to install antenna mount

Extension tube (some installations).



## **Additional Tools and Materials**

Safety goggles  
Dust mask  
Pencil  
Level  
Electric drill  
Drill bits  
Deck gland (some installations)  
Phillips screwdrivers  
Plumber's tape (optional)  
Grommets (some installations)  
Cutting pliers (some installations)  
Wire strippers (some installations)  
Electrical tape (some installations)  
Cable ties (some installations)

## **Where to Purchase Parts**

Obtain parts from your instrument manufacturer or marine dealer.

Gemeco	Tel: 843.394.3565
(USA)	Fax: 843.394.3736
	Email: <a href="mailto:sales@gemeco.com">sales@gemeco.com</a>

Airmar EMEA	Tel: 33.(0)2.23.52.06.48
(Europe, Middle East, Africa)	Fax: 33.(0)2.23.52.06.49
	Email: <a href="mailto:sales@airmar-emea.com">sales@airmar-emea.com</a>



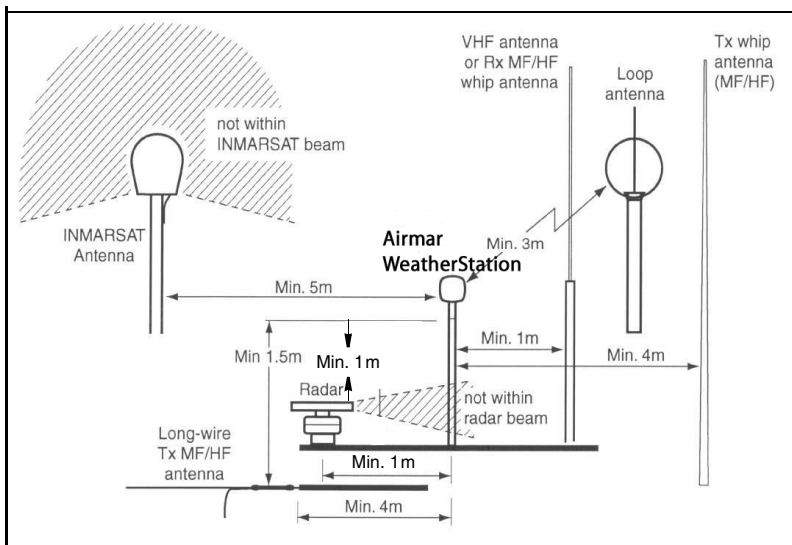


Figure 2. Antennas  
Courtesy of Northstar BNT, Acton, MA

## Choosing the Mounting Location

For accurate readings and a reliable GPS signal, selecting the best location for the WeatherStation instrument is very important. Easy access and appearance should be secondary considerations. Since each installation is unique, the best separation distances from other equipment on the boat will vary depending on the particular equipment and how it is configured. Choose a location that balances the requirements below (see Figure 2).

- The WeatherStation instrument *must* be mounted in “clear air”—away from obstructions in any direction that will interfere with air flowing through the unit. If there is an obstruction, *be sure* to mount the WeatherStation instrument at least 2m (6') away. On land, avoid roof tops, chimneys, trees, etc.
- If possible, mount the WeatherStation instrument higher than any other object. Mount it a minimum of 500mm (20") above the surrounding surfaces.

**NOTE:** *The higher the WeatherStation instrument is mounted, the less accurate the pitch and roll readings will be.*

- Because the WeatherStation instrument has an electronic compass, it should be at least 1 m (3') away from any on-board radar equipment or other strong magnetic fields from equipment such as radio transmitters, boat engines, generators, etc.
- Because the WeatherStation instrument has a GPS, it *must* be lower than any on-board INMARSAT communications antenna.
- Because the WeatherStation instrument has a GPS, *be sure* it is as far as possible from high-powered transmitting antennas to avoid mutual interference.
- Because the WeatherStation instrument has a GPS, check for any electromagnetic shading. That is, any obstructions from other vessels or shoreline buildings that will interfere with the GPS signals that the WeatherStation instrument *must* receive.

## Installing

**WARNING:** Always wear safety goggles and a dust mask.

**CAUTION:** The blue metal plate and the blue film found in the wind channel of the WeatherStation instrument are essential to its operation (see Figure 3). Be careful not to scratch the plate, puncture the film, or damage them in any way.

**CAUTION:** Do not remove the waterproof connector(s) to ease cable routing. If the cable must be cut and spliced, use Airmar's splash-proof Junction Box No. 33-035 and follow the instructions supplied. Removing the waterproof connector(s) or cutting the cable, except when using a water-tight junction box, will void the WeatherStation instrument warranty.

**CAUTION:** The WeatherStation instrument must be installed vertically—NOT tilted to one side. If the WeatherStation instrument is tilted from the horizontal plane, it will introduce an error in the compass reading.

**CAUTION:** Be sure the alignment tabs on the WeatherStation instrument point forward toward the bow and parallel to the centerline of the boat. This is necessary to accurately measure wind direction and vessel heading.

**CAUTION:** Do not tighten or align the WeatherStation instrument by rotating the upper cap (see Figure 3). Turning may sever internal connections and void the warranty. Grasp the lower housing below the blue metal plate. Hand-tighten only.



Figure 3. Wind channel

Copyright © 2008 Airmar Technology Corp.

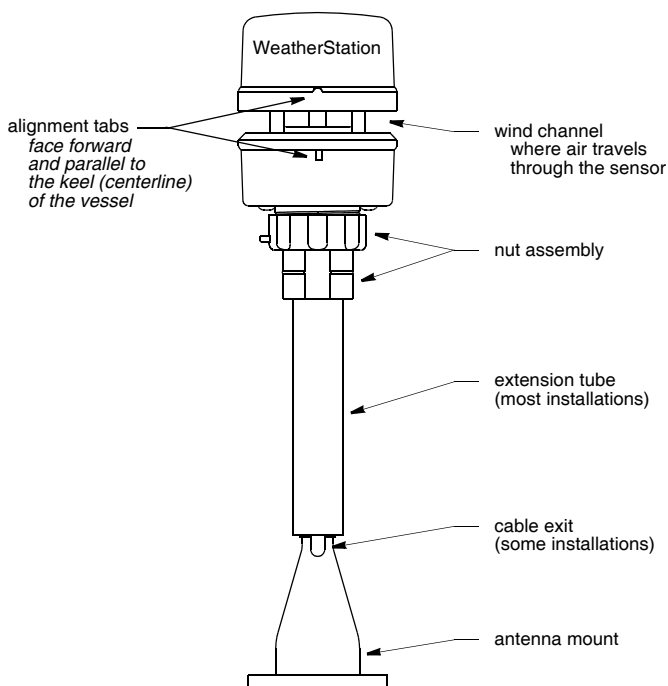
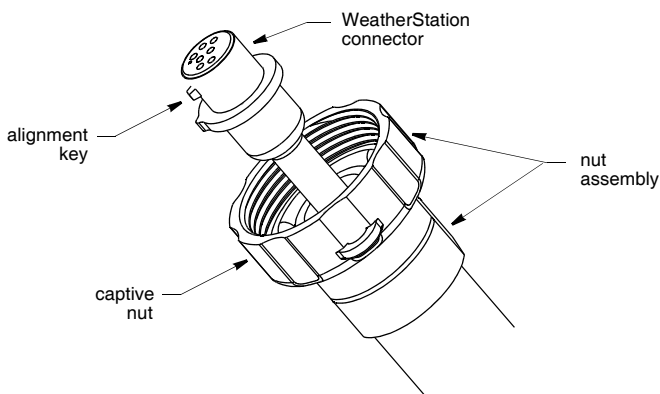


Figure 4. Installation

Copyright © 2007 Airmar Technology Corp.

**WARNING:** Always wear safety goggles and a dust mask.

1. Place the antenna mount at the selected location and mark the holes for the screws (see Figure 1). Also, mark the hole in the center of the mount for the cable to pass through. If you are using a ratchet mount, *be sure* you have purchased an extension with a cable pass-through.
2. Position the antenna mount at a 90° angle to the waterline. If necessary, use shims to make the mounting surface level (see Figure 4).
3. Drill the holes for the mounting screws and the cable exit if necessary. If the cable is to be fed through the deck, install a high quality deck gland.
4. Using purchased screws, fasten the antenna mount in place.
5. Screw an extension tube onto the antenna mount if desired.



**Figure 5. Connecting**  
Copyright © 2007 Airmar Technology Corp.

6. With the nut assembly on the cable near the WeatherStation connector, thread the cable through the extension tube (if used), antenna mount, and the cable exit. *Be sure to leave several inches of cable extending beyond the nut assembly* (see Figure 5).

**CAUTION:** If you use a thread lock, use plumber's tape. Do not use a liquid thread lock as it may weaken the plastic, causing it to swell and crack.

7. Screw the nut assembly onto the top of the antenna mount/extension tube. **Hand-tighten only.** *Do not* over tighten.
8. Remove the caution label from the WeatherStation instrument's socket. Remove the protective cover from the connector. (Save the cap to protect the connector, when the WeatherStation instrument is removed.) Plug the 9-pin connector into the WeatherStation instrument. The alignment key on the connector fits into a notch in the base of the WeatherStation instrument.
9. Grasp the lower housing of the WeatherStation instrument below the blue metal plate. *Being sure* the alignment tabs are facing forward and parallel to the keel (centerline) of the boat, slide the captive nut upward and screw it onto the base of the WeatherStation instrument (see Figures 4 and 5). **Hand-tighten only.** *Do not* over tighten. Be careful **NOT** to rotate the WeatherStation instrument or loosen the nut assembly from the antenna mount/extension tube. *Double check to be sure the alignment tabs are still facing forward.*

## Cable Routing & Connecting Guidelines

You must read the safety instructions below before going to the section that is appropriate for your equipment.

**WARNING:** Always wear safety goggles and a dust mask.

**WARNING:** The power supply voltage must be 12 VDC ( $\pm 3$ VDC).

**WARNING:** A safe installation requires a 1 amp fast-blow fuse or circuit breaker.

**CAUTION:** To reduce electrical interference from other electrical wiring and any on-board equipment with strong magnetic fields such as radar equipment, radio transmitters, boat engines, generators, etc., separate the cables by at least 1 m (3').

**CAUTION:** Do not remove the waterproof connector(s) to ease cable routing. If the cable must be cut and spliced, use Airmar's splash-proof Junction Box No. 33-035 and follow the instructions supplied. Removing the waterproof connector or cutting the cable, except when using a water-tight junction box, will void the instrument's warranty.

**CAUTION:** Be careful not to tear the cable jackets when passing them through bulkheads and other parts of the boat. Use grommets to prevent chaffing.

**CAUTION:** Use a multimeter to check the polarity and the connections to the 12VDC power supply before applying power to the instrument.

**CAUTION:** Coil any excess cable(s) and secure with cable ties to prevent damage.

**IMPORTANT:** Make power connections to a 12 VDC power source that is isolated from the engine start battery(s). Voltage drops may cause the instrument/receiver/sensor to lose information and/or change operating mode.

## Connecting to an NMEA 0183 Display

1. Route the WeatherStation cable to the display. *Do not* fasten the cable in place at this time.
2. Connect the WeatherStation instrument to the display in one of two ways.
  - **Connector**—If your WeatherStation instrument came with a connector on the display end, and it can be plugged into the port on your NMEA 0183 display, do so now. Coil any excess cable and secure it with cable ties to prevent damage. Fasten the cable in place.
  - **No connector**—If your WeatherStation instrument does not have a connector on the display end, it must be hard wired. Refer to the owner's manual that came with your display and connect the colored wires as shown in the table below and Figure 6.

WeatherStation Function	WeatherStation Cable	Display Function
NMEA input A/+	Yellow	NMEA output A/+ (see Note 2)
NMEA input B/-	Orange	NMEA output B/-
NMEA output A/+	White	NMEA input A/+
NMEA output B/-	Blue	NMEA input B/-
12 VDC +	Red (see Note 1)	12 VDC + (see Note 3)
12 VDC -/ground	Black	12 VDC -/ground
Shield	Bare	Shield

**Note 1:** The WeatherStation instrument must be supplied with 12 VDC ( $\pm 3$ VDC) at 0.5 amp.

**Note 2:** If your display does not have NMEA 0183 output connections, the yellow and orange wires are not needed and their ends should be taped separately. (Alternatively, yellow and orange wires can be connected to an external sensor.)

**Note 3:** The display power may be wired directly to the WeatherStation cable, or it may be wired separately.

### No Connector—Wiring

1. Allowing an extra 25 cm (10") for wiring ease, cut the cable to length.
2. Strip 60 mm (2-1/2") of the outer jacket and foil shielding from the cut end of the cable (see Figure 6).
3. Strip 10 mm (3/8") of conductor insulation from the end of each colored wire.
4. Protect the cable's foil shielding from causing a short by using heat-shrink tubing around the jacket where the wires emerge from the cable. The tubing must overlap the wires a minimum of 6 mm (1/4").
5. Connect the wires to the display (see Figure 6).
6. Fasten all cable in place.

7. Your installation is complete. To begin receiving weather readings, refer to the owner's manual that came with your display.

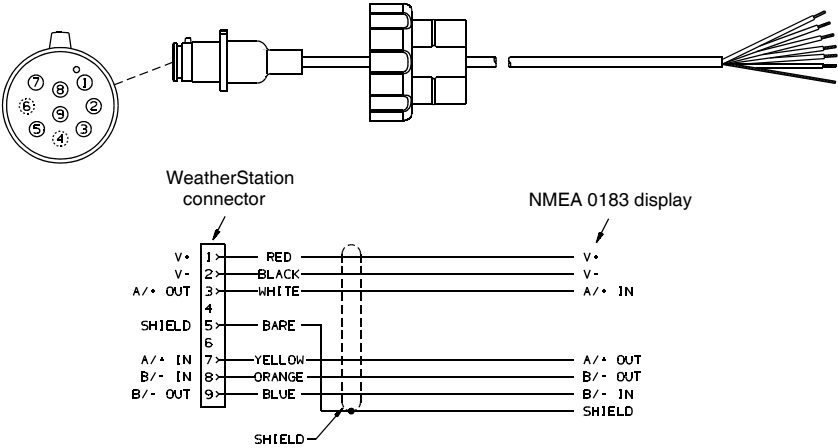


Figure 6. Wiring diagram to connect to an NMEA display  
Copyright © 2007 Airmar Technology Corp.

# Connecting to an NMEA 2000® Network

**CAUTION:** Only two termination resistors are required on an NMEA 2000 network. More than two will degrade the bus performance.

**IMPORTANT:** When using a cable that is longer than 6m (20'), remove the termination resistor at the last node/tee on the NMEA 2000 network. Insert the male-to-male pin into socket 5 of the WeatherStation connector to activate the termination resistor located inside the WeatherStation instrument.

Route the WeatherStation cable to the NMEA 2000 network. Plug the NMEA 2000 connector into the network node (see Figure 7). Coil any excess cable and secure with cable ties to prevent damage.

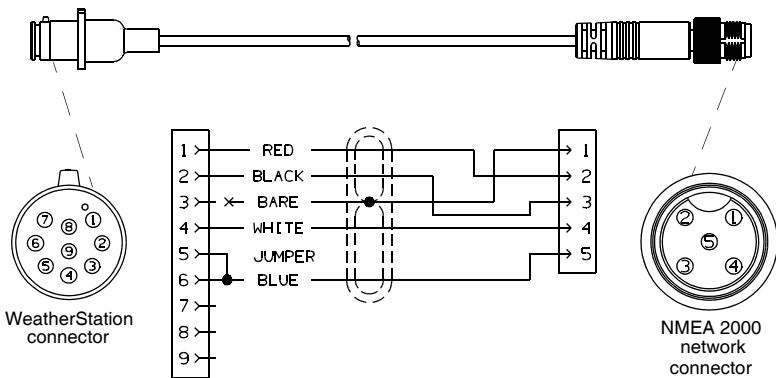


Figure 7. NMEA 2000 cable

Copyright © 2008 Airmar Technology Corp.



## Calibrating the Compass

The internal compass must be calibrated for accurate compass readings. To calibrate the compass, use the WeatherCaster™ software and a PC.

## Software

### Installing the Software

Follow the instructions in the *WeatherCaster™ Software Guide*.

### Software Updates

Airmar may release updated versions of the firmware. The latest revision will be available for download through an email to you, from Airmar's website, [www.airmar.com](http://www.airmar.com), or a CD can be mailed by Airmar's technical support personnel.

## Maintenance

Since the WeatherStation instrument has no moving parts, it requires minimal maintenance.

**CAUTION:** The blue metal plate and the blue waterproof film found in the wind channel of the WeatherStation instrument are essential to its operation (see Figure 8). The blue waterproof film protects the transducers, so *be careful* to keep it intact. Do not to scratch the metal plate or damage it in any way.

**IMPORTANT:** Keep the wind channel free of *SPIDER WEBS*, insects, dirt, and other debris.

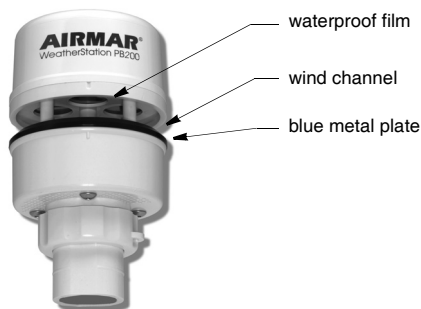


Figure 8. Wind channel

Copyright © 2008 Airmar Technology Corp.

## Where to Purchase Parts

Obtain parts from your marine dealer.

Gemeco  
(USA)

Tel: 843.394.3565  
Fax: 843.394.3736  
Email: sales@gemeco.com

Airmar EMEA  
(Europe, Middle East, Africa)

Tel: 33.(0)2.23.52.06.48  
Fax: 33.(0)2.23.52.06.49  
Email: sales@airmar-emea.com

## Troubleshooting

### No Readings or Inaccurate Readings

- Is there power to the WeatherStation instrument?
- Are all the connections tight?
- Is the cable-run free of kinks?
- Is the wiring correct?
- Are there any obstructions in the wind channel of the WeatherStation instrument?  
Keep it free of *spider webs*, insects, dirt, and other debris. *Be careful not to puncture the blue waterproof film or scratch the blue plate.*
- Is there ice on the WeatherStation instrument?

### No GPS Fix

- Does the WeatherStation instrument have a clear view of the sky?

### Wind Readings Are Too Low

- Is the WeatherStation instrument mounted forward and low on the boat's hardtop in dead air?  
Move the instrument farther back and higher (see Figure 9).

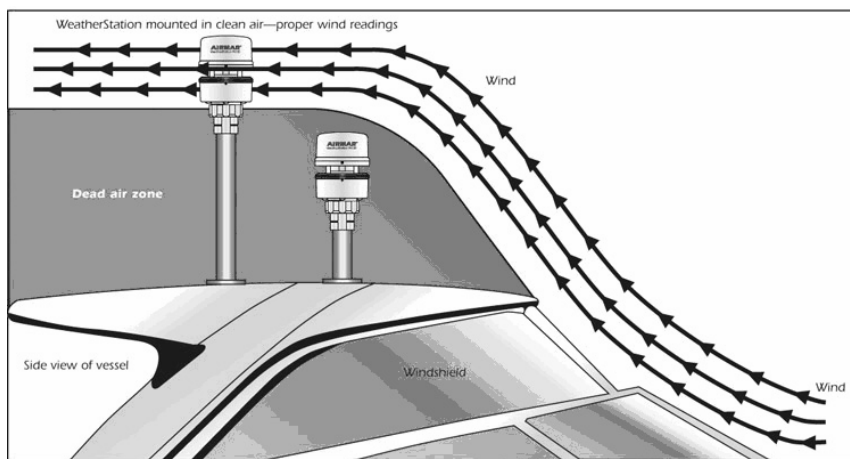


Figure 9. Mounting location

Copyright © 2007 Airmar Technology Corp.

## NMEA 0183 Combiner Problems

The LED light on the Combiner indicates its current operating mode and if an error is detected during the self-test process. See the table below.

Color and Flash Count	Mode and Error Condition	Description of Mode and Required User Action
Red No flashing	Start-up mode No error	Normal operation mode that should last for no more than 1.5 seconds. Any longer indicates an error with the program. No action required.
Red No flashing	Flash Updating mode No error	The LED will stay red for the duration of the flash update operation. When the operation is complete, the Combiner will automatically reset. No action required.
Amber No flashing	Initialize & Self-test mode No error	Normal operation mode that follows the start-up mode and should last for approximately 1 second. No action required.
Green No flashing	Normal & No Data mode No error	Normal operation mode that follows the Initialize & Self-test mode. Indicates that no error was detected during self-test. Also, no data is currently being received by the Combiner. No action required.
Green Flashing (1–10 per sec.)	Normal & Data Receive mode No error	Normal operation mode that indicates data is being received by the Combiner. The flash rate is proportional to the Baud rate. No action required.
Amber Flashing (1 every 4 sec.)	Error Trap mode EEPROM memory error	An error with the EEPROM memory has been detected during the self-test mode. Reset the Combiner by powering down, waiting 60 sec., then restarting the Combiner.

## PC Problems

If you are uncertain of the COM port on your PC, follow the steps below.

1. From the Start menu, select Control Panels.
2. Select the System option.
3. Select the Hardware tab.
4. Select Device Manager.
5. Select Ports.
6. Select Airmar NMEA 0183 – USB Converter.

The Converter is powered when it is connected to the USB port on the PC.

## Appendix A—How the WeatherStation Instrument Works

### About the Ultrasonic Wind Sensor

The ultrasonic wind sensor (an ultrasonic anemometer) measures apparent wind speed and direction. The WeatherStation instrument contains four ultrasonic transducers, visible through the four holes in the top of the sensor's wind channel (see Figure 10). These transducers operate in pairs—one transducer injects a pulse into the air. The pulse bounces off the metal plate at the bottom of the wind channel and is carried by the wind to arrive at the listening transducer a short time later.

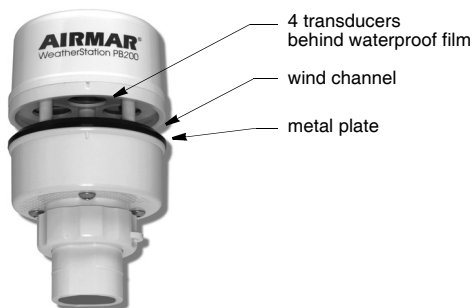


Figure 10. WeatherStation ultrasonic wind sensor

Copyright © 2007 Airmar Technology Corp.

When there is no wind, the pulse travels at the speed of sound from the sender to the receiver. Whenever the wind is blowing in that direction, the pulse will arrive sooner than if the air is still. Similarly, whenever the wind is blowing in the opposite direction, the pulse will arrive later than if the air is still. The four transducers take turns in sending and receiving pulses.

A microprocessor within the WeatherStation instrument then combines the measurements from all four transducers to calculate the resultant wind speed and direction. Throughout this process, the sensor monitors the air temperature, to compensate for the fact that the speed of sound in air changes with temperature.

### Understanding True and Apparent Wind

The WeatherStation instrument has the unique ability to display both *true* and *apparent* wind. *True* wind is the actual motion of the air relative to the earth. *Apparent* wind is the wind which an observer experiences while moving or on board a boat. It is the result of two motions—the actual motion of the air (the true wind) and the motion of the boat. If the vessel is not moving, then the true and apparent wind will be the same.

There are two components to any wind measurement: speed and direction. By convention, the wind direction is an angle representing the direction *from* which the wind is blowing. Sometimes this angle is referenced to true or magnetic north, and sometimes it is referenced to the bow of the vessel. Both true and apparent wind use these same references.

Consider the case of a vessel proceeding at a speed of 15 knots in calm air. An observer on board would experience a wind of 15 knots from dead ahead. This *apparent* wind would be due solely to the motion of the boat. If a *true* wind of 15 knots was blowing from the stern, an observer would experience dead calm—no *apparent* wind. That is because the boat is moving at the same speed and in the same direction as the surrounding air.

Now, consider the more complicated situation of a vessel proceeding at 15 knots with a *true* wind of 15 knots blowing from the side (see Figure 11). To an observer on board, the *apparent* wind would be 21.2 knots blowing from an angle 45° off the bow.

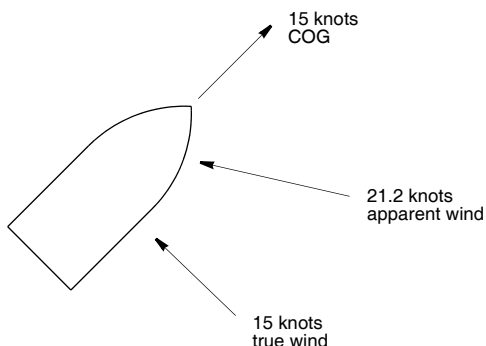


Figure 11. Apparent wind

Copyright © 2007 Airmar Technology Corp.

In order to calculate the true wind speed and direction when on board a moving vessel, it is necessary to know the apparent wind speed and direction, the speed and course over ground of the vessel, the compass heading, and the local magnetic variation. Note that heading and course are not the same thing: heading is the direction the bow of the vessel is pointing, while course is the direction the vessel is traveling. Heading and course may differ due to the effects of wind and current. The WeatherStation instrument can provide true wind speed and direction only if all of the data is available. The speed and course over ground must be provided by a GPS receiver—either built-in or networked. The heading may be provided by either the built-in electronic compass or by an external networked compass.

Because true wind is calculated using the data from several sensors, its accuracy depends on the accuracy of all the raw data used in the calculation. For instance, if the electronic compass is located near iron or a similar magnetic disturbance, the heading will be incorrect, and the true wind calculation will therefore be in error, perhaps by quite a bit. In another example, the speed and course over ground provided by the GPS receiver are averaged over time. If the boat is performing maneuvers, changing speed and/or direction, then it will take a few seconds for the SOG and COG values to "catch up". The reported true wind values will therefore also be incorrect until the vessel reaches a steady-state condition, traveling in a straight line at a constant speed.

## **About the Electronic Compass**

The WeatherStation instrument includes three magnetoinductive sensors that measure magnetic field-strength in three axes relative to the instrument. From combined measurements of the three-axis magnetic and tilt sensors, it calculates the resultant magnetic heading angle, thereby providing a built-in three-axis electronic compass.

Like all magnetic compasses, the WeatherStation compass will be affected by any ferrous or magnetic materials in the vicinity, such as metal structures, motors, speakers, etc. It will also be affected by nearby electric fields, such as the wiring for navigation lights or radar domes. These nearby sources of magnetic interference will distort the magnetic field and produce errors in the compass heading. These errors are known as magnetic deviation.

## **About Magnetic Variation and True Heading**

The earth acts like a giant magnet, with a magnetic north pole and a magnetic south pole. The axis of the magnetic poles is offset approximately  $11.5^\circ$  from the axis of the earth's rotation. Therefore, the earth's magnetic north and south poles are in different locations than the earth's geographic north and south poles. In addition, the earth's magnetic field is non-uniform, and changes over time. Magnetic variation, also known as magnetic declination, is the angle between magnetic north and true (or geographic) north, at the observer's current location.

A magnetic compass measures heading with respect to magnetic north. To convert this magnetic heading to true heading (that is, heading with respect to true north), the magnetic variation must be added to the measured magnetic heading value.

Because magnetic variation changes with location and gradually over time, it is necessary to calculate the magnetic variation using the user's present position and the current date. Therefore it is necessary to have a GPS with a fix in order to provide magnetic variation and heading with respect to true north.

## **About the Air Temperature Sensor**

The WeatherStation instrument includes a built-in negative-temperature-coefficient thermistor that measures the ambient air temperature. This NTC thermistor is located in a thermally isolated region of the WeatherStation housing that is open to the outside air.

## **About Wind Chill Temperature**

Wind Chill is a term that describes the heat loss on the human body resulting from the combined effects of low temperature and wind. As wind speed increases, heat is carried away from the body at a faster rate, causing a reduction in skin temperature. Because the face is the part of the human body that is most likely to be exposed, the wind-chill index is adjusted for the average adult face.

The concept of wind chill does not apply to inanimate objects, such as a boat. The only effect that wind chill has in this case is to shorten the time it takes the object to cool to the actual air temperature—wind chill does not cause an object to cool below that temperature. For example, fresh water freezes at  $0^\circ\text{C}$  ( $32^\circ\text{F}$ ) regardless of what the wind chill is.

The WeatherStation instrument calculates two values for wind-chill temperature: one using the apparent wind-speed, and one using the true wind-speed. The *apparent* wind-chill temperature is relevant to what an observer is currently experiencing on the vessel. The *true* wind-chill temperature indicates what the wind chill would be if the vessel were not moving.

Wind chill temperature is only defined for temperatures at or below 10°C (50°F) and wind speeds above 2.6 knots (3MPH).

By default, transmission of wind-chill data is disabled by the WeatherStation instrument. When used with WeatherCaster software, the wind-chill data will be automatically enabled.

### **About the Barometric Pressure Sensor**

The WeatherStation instrument contains a temperature-compensated, silicon, piezoresistive, pressure sensor. It measures atmospheric pressure for use as a digital barometer. While a single measurement of air pressure at a given location has little value, the trend of changing pressure and wind over time can be a useful tool in performing basic weather forecasting.

### **About the GPS**

Some WeatherStation instruments have a built-in Global Positioning System with their own antenna, receiver, and position determining electronics. The GPS receiver receives radio signals from a constellation of orbiting satellites maintained by the U.S. government. By accurately measuring the time it takes for a transmission to travel from each satellite to the receiver, the unit is able to determine the distance between the satellite and the receiver. When the distance is known to three satellites, the unit is able to calculate the latitude and longitude of the receiver. This is known as a 2D fix. If the distance is known to four or more satellites, then the unit is additionally able to calculate the altitude of the receiver. This is known as a 3D fix.

The GPS receiver in the WeatherStation instrument takes approximately one minute on average to achieve a position fix after power is first applied. This is known as the "time to first fix."

The GPS receiver synchronizes itself to the atomic clocks on board each satellite. This allows the GPS receiver to accurately determine the date and time as well.

If the GPS receiver is mounted on a moving vessel, its changing position over time allows the speed and course over ground to be calculated. The course reported by a GPS is always with respect to true north.

The ability of the WeatherStation instrument to calculate true wind speed and direction depends on the presence of a GPS fix. If the GPS receiver is not tracking at least three satellites, then the WeatherStation instrument will be unable to provide true wind data. (Apparent wind data should always be available, regardless of the status of the GPS receiver.)

Certain models of the WeatherStation instrument do not include a built-in GPS receiver. In this case, if the true wind capabilities of the WeatherStation instrument are desired, it will be necessary to connect the output from an external NMEA 0183-capable GPS to the NMEA input on the WeatherStation instrument (or to the

optional Combiner), in order to enable the true wind capabilities of the WeatherStation instrument.

Even if your WeatherStation instrument includes a built-in GPS receiver, you may wish to use a separate external GPS receiver instead, for the determination of true wind. If the WeatherStation instrument receives speed over ground and course over ground (SOG and COG) data on its NMEA input from an external GPS, these data will override the data from the built-in GPS for the purpose of calculating true wind speed and direction. In addition, the WeatherStation instrument will automatically suppress transmission of GPS messages from its own built-in GPS receiver.

### **About True Wind Relative to Water**

If a fix from a GPS receiver is not available, it is still possible for the WeatherStation instrument to determine a value for true wind, if the speed of the vessel through the water is known. In this case, it is necessary that a water-speed sensor with an NMEA output (such as an Airmar Smart™ Sensor) be connected to the NMEA input on the WeatherStation instrument (or to the optional Combiner).

The WeatherStation instrument's calculation for true wind relative to water makes the significant simplifying assumption that the vessel's course is the same as its heading. That is, the effects of wind and current on the motion of the boat are ignored. The direction of the true wind relative to water is referenced only to the bow of the vessel, not to true or magnetic north.



## Appendix B—Technical Information

### NMEA 0183 Sentence Commands

\* These sentences are enabled at the factory.

\$GPDTM	Datum Reference
\$GPGGA *	GPS Fix Data
\$GPGLL	Geographic Position –Latitude/Longitude
\$GPGSA	GNSS DOP and Active Satellites
\$GPGSV	GNSS Satellites in View
\$HCHDG	Heading, Deviation and Variation
\$HCHDT	Heading True
\$WIMDA *	Meteorological Composite. Barometric Pressure, Air Temperature, Wind Direction, Wind Speed
\$WIMWD	Wind Direction and Speed, with respect to north
\$WIMWV *	Wind Speed and Angle, in relation to the vessel's bow /centerline (relative)
\$WIMWV	Wind Speed and Angle, in relation to the vessel's bow /centerline (theoretical)
\$GPRMC	Recommended Minimum Specific GNSS Data
\$TIROT *	Rate of Turn
\$GPVTG *	Course Over Ground and Ground Speed
\$WIVWR	Relative Wind Speed and Angle
\$WIVWT	True Wind Speed and Angle
\$YXXDR	Transducer Measurements: Wind Chill and Vessel Attitude
\$GPZDA *	Time and Date
\$PFEC, GPatt *	Heading, Pitch, and Roll
\$PFEC, pidat	

### *Additional Data Available from the WeatherStation Instrument*

There are parameters that the WeatherStation instrument can make available to the user. Usually, more data is available from the WeatherStation instrument than can be displayed in a reasonable format on a screen. Also, if all the data was continuously transmitted to the display, the update rate would be too slow and could not keep up with WeatherStation measurements. Consequently, some parameters are transmitted while others are not, based on a pre-selected list—the NMEA 0183 sentences with an asterisk. Note that those parameters not transmitted are, nevertheless, retained in the WeatherStation instrument. For more detailed information, see the “Technical Manual” on the WeatherStation CD.

### NMEA 2000® PGN Commands

#### *Transmitted NMEA 2000® PGNs*

PGN 059392	ISO Acknowledgment
PGN 060928	ISO Address Claim
PGN 065285	Proprietary: Boot State Acknowledgment
PGN 065287	Proprietary: Access Level
PGN 126208	Acknowledge Group Function
PGN 126464	PGN List - Transmit/Received PGN's Group
PGN 126720	Addressable Multi-Frame Proprietary
PGN 126720-32	Proprietary: Attitude Offsets

PGN 126720-33	Proprietary: Calibrate Compass
PGN 126720-34	Proprietary: True Wind Options
PGN 126720-35	Proprietary: Simulate Mode
PGN 126720-49	Set WAAS Satellite
PGN 126720-50	Set Tzz Parameter
PGN 126992	System Time
PGN 126996	Product Information
PGN 126998	Configuration Information
PGN 127250	Vessel Heading
PGN 127251	Rate of Turn
PGN 127257	Attitude
PGN 127258	Magnetic Variation
PGN 129025	Position, Rapid Update
PGN 129026	COG & SOG, Rapid Update
PGN 129029	GNSS Position Data
PGN 129033	Time & Date
PGN 129044	Datum
PGN 129538	GNSS Control Status
PGN 129539	GNSS DOPs
PGN 129540	GNSS Sats in View
PGN 130306	Wind Data
PGN 130310	Environmental Parameters
PGN 130311	Environmental Parameters
PGN 130323	Meteorological Station Data
PNG 130822	Unit Division Code (FEC)
PNG 130823	Browser Control Status (FEC)
PGN 130880	Proprietary: Additional Weather Data
PGN 130881	Proprietary: Heater Control
PGN 130944	Proprietary: POST
PGN 65281	Terminator Status (FEC)

### ***Received NMEA 2000® PGNs***

PGN 059904	ISO Request
PGN 060928	ISO Address Claim
PGN 065286	Proprietary: Boot State Request
PGN 126208	Request Group Function
PGN 126208	Command Group Function
PGN 126720	Addressable Multi-Frame Proprietary
PGN 126720-1	Proprietary: Master Reset
PGN 126720-130	Proprietary: Reset EEPROM
PGN 126720-132	Proprietary: Reset GPS
PGN 128259	Speed
PGN 126208	WAAS ON/OFF
PGN 130821	NavSource Speed (FEC)

### ***Additional Data Available from the WeatherStation Instrument***

There are parameters that the WeatherStation instrument can make available to the user. Usually, more data is available from the WeatherStation instrument than can be displayed in a reasonable format on a screen. Consequently, some parameters are transmitted while others are not. Note that those parameters not

transmitted are, nevertheless, retained in the WeatherStation instrument. For more detailed information, see the “Technical Manual” on the WeatherStation CD.

## Baud Rate

WeatherCaster™ software needs the baud rate to be set as follows:

NMEA 0183 USB Converter	baud rate 4800.
NMEA 0183 Combiner	baud rate 38400.

## Load Equivalency Number

LEN..... 13

## Calibration

The WeatherStation instrument is calibrated at the factory and does not require any calibration after purchase.

## Acronyms

CD	Compact Disk
COG	Course Over Ground
COM Port	Communications Port
DOP	Dilution Of Precision
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
LED	Light Emitting Diode
LEN	Load Equivalency Number
PC	Personal Computer
SOG	Speed Over Ground
UNS	Unified National Standard
USB	Universal Serial Bus
WAAS	Wide Area Augmentation System
2D	Two Dimensional GPS Fix
3D	Three dimensional GPS Fix

## Glossary

Firmware	The software within the WeatherStation hardware
WeatherCaster™ software	The PC application program

## Trademarks

Airmar® is a registered trademark of Airmar Technology Corporation.  
NMEA 2000® is a registered trademark of the National Marine Electronics Assoc.  
Smart™ Sensor is a trademark of Airmar Technology Corporation.  
WeatherCaster™ is a trademark of Airmar Technology Corporation.  
WeatherStation® is a trademark of Airmar Technology Corporation.



35 Meadowbrook Drive, Milford, New Hampshire 03055-4613, USA  
[www.airmar.com](http://www.airmar.com)